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JSC 12618

CR 151339

# PROGRAM DOCUMENTATION
# FOR
# ELAPSED TIME TO OXYGEN AND HYDROGEN
# CAUTION AND WARNING SYSTEM
# FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS
# CPD 710

(NASA-CR-151339) PROGRAM DOCUMENTATION FOR ELAPSED TIME TO OXYGEN AND HYDROGEN CAUTION AND WARNING SYSTEM FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS (Lockheed Electronics Co.) 8 p HC A02/MF A01 CSCL 22A G3/18

N77-23187

Unclas 26141

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Contract NAS 9-15200
For
Avionics Systems Engineering Division



*National Aeronautics and Space Administration*

***LYNDON B. JOHNSON SPACE CENTER***

*Houston, Texas*
April 1977

LEC-10443

JSC 12618

# PROGRAM DOCUMENTATION
# FOR
# ELAPSED TIME TO OXYGEN AND HYDROGEN CAUTION AND WARNING SYSTEM FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS

Job Order 81-147

CPD 710

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April 1977

LEC-10443

# 1. INTRODUCTION

This memorandum provides the results for special High Pressure Gas Storage (HPGS) simulation runs that were made to compute the elapsed time from T-0 disconnect (transfer to onboard reactant) to the caution and warning pressures for the primary oxygen ($O_2$) and hydrogen ($H_2$) systems of Orbiter Vehicle (OV) 101. The simulation runs were made for Approach and Landing Test (ALT) flights Captive/Active 1 and Captive/Active 3. The data for this memorandum were drawn from the simulation runs described in reference 1.

## 2. SYMBOLS

| | |
|---|---|
| ALT | Approach and Landing Test |
| C/A | Captive/Active |
| C/W | Caution and Warning |
| $H_2$ | Hydrogen |
| HPGS | High Pressure Gas Storage |
| hr | Hour |
| lb | Pounds |
| $O_2$ | Oxygen |
| OV | Orbiter Vehicle |
| psia | Pounds per Square Inch Absolute |

## 3. METHOD

Special simulation runs were made using the HPGS program to determine the amount of elapsed time required for primary $O_2$ and primary $H_2$ tanks to cross over to the secondary $O_2$ and $H_2$ tanks (ref. 1). From these simulation runs, elapsed time to caution and warning pressures and quantities remaining in the primary systems at these pressures were taken.

To determine the required data values, the following assumptions were used in performing the analyses, together with the assumptions and constraints described in reference 1.

$O_2$ and $H_2$ caution and warning (C/W) pressures are defined as:

a. $O_2$ C/W pressure is 1170 psia.

b. $H_2$ C/W pressure is 720 psia.

# 4. RESULTS

The results for the analyses are presented in table I, which shows the elapsed time from T-0 disconnect to the C/W pressures, the quantity remaining at the C/W pressures, and the elapsed time from C/W to primary/secondary system cross over.

This memorandum fulfills the requirement request mady by T. Davies of NASA/EP5.

TABLE I. - CAPTIVE/ACTIVE 1 AND 3 CAUTION AND WARNING DATA

| | CAPTIVE ACTIVE 1 | | CAPTIVE ACTIVE 3 | |
|---|---|---|---|---|
| | $O_2$ | $H_2$ | $O_2$ | $H_2$ |
| Elapsed time to C/W, hr | 3.3230 | 3.710 | 3.3233 | 3.716 |
| Quantity remaining in primary system, lb | 55.899 | 2.956 | 55.898 | 2.947 |
| Elapsed time from C/W to primary/secondary crossover, hr | 1.530 | 1.490 | 1.526 | 1.489 |

## 5. REFERENCES

1. Hurst, J.E.: Captive Active 1 and 3 Energy Requirements for Primary/ secondary Crossover, AMD 037,Lockheed Electronics Company, Inc., March 15, 1977.